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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/753,662 | 01/04/2001 | Shigeto Fujimura | 1592-0131P | 1881 |

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EXAMINER

ANDERSON, MATTHEW A

ART UNIT PAPER NUMBER

1765

DATE MAILED: 03/18/2003

17

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/753,662

Applicant(s)

FUJIMURA ET AL.

Examiner

Matthew A. Anderson

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 January 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4 and 11 is/are pending in the application.
- 4a) Of the above claim(s) 5-10 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 and 11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 January 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claim 1-3, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuda et al. (US 5,554,219) in view of Dutta et al. (US 6,273,969 B1) and Kingery et al. (Introduction to Ceramics, Second Ed., John Wiley & Sons, New York, USA, pp. 328-346, 1976.)

Fukuda et al. discloses a process for the production of bulk single crystal ZnSe (zinc selenide). Zn Se is disclosed in the first sentence of col. 1 as a known semiconductor used in, for example, lasers. The background in the same column stresses the need to avoid twinned (i.e. poly-crystal) growth during the production of bulk monocrystals of ZnSe. In lines 18-29 and 44-57 is delineated the process. A VF (vertical Bridgeman as in the claims) or a VGF (vertical gradient freezing) furnace was used. A crucible was used to contain the melt within the vertical furnace. The raw material was melted and then a portion at the lower tip of the crucible was solidified by cooling. The crystal growth was

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then stopped. Then part of the resultant poly-crystalline ZnSe in the crucible tip was remelted. Then, from the lower surface of the melt in contact with the remaining solid raw material, crystallization was resumed by cooling the melt by moving the crucible down at a certain rate. The result was twin-free bulk ZnSe. The examiner notes that nuclei are the art accepted points at which crystal growth is initiated.

Fukuda et al. does not explicitly disclose the nucleation as promoted by the solid raw material or the use of an encapsulant.

Dutta et al. discloses the method for making alloys of semiconductors including ZnTe, ZnSe, CdTe, CdSe (col. 4 lines 49-56) by VF methods including the use of an encapsulant including boric oxide (B_2O_3). The encapsulant prevents the vaporization of a volatile component of the melt.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine the above references because thereby the growth using a VF method would produce an semiconductor alloy of constant stoichiometry due to the prevention of vaporization and the universally accepted nucleation/growth explanation of crystal formation would be understood.

It would have been obvious to one of ordinary skill in the art at the time of the present invention that, in a crucible existing in a vertical furnace in which a raw material had been melted and in which existed a solid portion of raw material which was yet not a seed crystal as per claim 1, crystal growth of a compound

semiconductor single crystal would have occurred because such is described by Fukuda et al in embodiment 5.

It would have been further obvious to one of ordinary skill in the art at the time of the present invention that the crystal growth occurred from nuclei existing at the surface of the solid raw material adjacent to the raw material melt because such growth occurred in Fukuda et al. and would have been consistent with the art accepted 'nucleation/growth' hypothesis of crystal growth presented by Kingery et al..

It would have been further obvious to one of ordinary skill in the art at the time of the present invention to use B_2O_3 as the encapsulant for a ZnTe or CdTe VF crystal growth method because such is suggested by Dutta et al. Dutta et al. discloses that VF methods are interchangeable for growing ZnSe, ZnTe, and CdTe.

3. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuda et al. and Dutta et al. as applied to claims 1-3, 11 above, and further in view of Taniguchi et al. (US 5,603,763).

The combination is described above.

The combination does not disclose nucleation on the top surface of the melt.

Taniguchi et al. discloses the formation of CdTe by a VF method of crystal growth. In col. 12 15-30 it is disclosed that the nuclei are formed only on top of

the melt away from the crucible wall and thus single crystals are easily obtained.

Taniguchi et al. uses a controlled atmosphere (Cd vapor) to control surface volatilization of Cd.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine the methods above because the atmosphere controlled method represented by Fukuda et al. and Dutta et al. is then protected from polycrystal (i.e. twin) formations. The substitution of one way of atmosphere control for another would have been obvious to one of ordinary skill.

Response to Arguments

The applicant's arguments from the Brief of 1/16/2003 have been considered but are not convincing.

The argument that there is no prima facie case of obviousness because each and every limitation is not covered by the references is not convincing. First, the characterization that "a large number of nuclei are generated " (paper 16, page 6 2nd para, second to last line) in effect admits that the required nucleation occurs in Fukuda although the reference does not explicitly mention nucleation. The examiner does understand the process of Fukuda et al. and contends that the steps outlined on page 7 are more limited than those of claim 1. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., nucleation occurs at the top surface of the

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melt just below the encapsulant) are not recited in the rejected claim 1. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Claim 4 does add this limitation. However it was previously rejected, also.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The references are combined as above with motivations as above.

The argument that no showing of motivation was made is false. Dutta explains that the encapsulant is used to ensure compositional stability of the melt since the components are extremely volatile at the temperature used in the process. Motivation, as described before, is a desire to ensure consistency from one run of the process to the next in terms of stoichiometry – a very definite advantage when speaking of semiconductor materials.

The obvious to try argument is not convincing. Dutta et al. discloses encapsulated VF growth of the specific compounds used by applicant. Why using the same encapsulant in a modified VF process to ensure stoichiometry is not at least suggested to one of ordinary skill in the art is not immediately apparent.

The argument against Taniguchi is not convincing. Taniguchi et al. discloses forming nuclei on top of a melt as described above. Again Taniguchi is part of a combination of references with previously presented motivations to combine. Just

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because the applicant does not agree with the motivation to combine previously given references does not mean one was not presented.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew A. Anderson whose telephone number is (703) 308-0086. The examiner can normally be reached on M-Th, 6:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

MAA
March 13, 2003


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